ABSTRACT

DISSERTATION/THESIS/RESEARCH PAPER/CREATIVE PROJECT: Petrophysical Characteristics and Geothermal Analysis of The Pematang Formation, Central Sumatra Basin, Indonesia

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Pematang Formation (Pematang Group), in the Central Sumatra Basin (CSB), is the most prolific hydrocarbon rock in the region. After recent volcanic activities and more than a decade of exploration, a hydrocarbon potential re-exploration has recently begun in the region. The most recent publication about the study area was a decade ago, a geochemical framework to estimate the TOC in Pematang Formation. Additionally, there were almost no geophysics exploration methods applied in the study area. The goal of this study is to analyze the potential Pematang Formation quality as a hydrocarbon source rock at Tonga PT Mosesa Petroleum Block (TPTMPB), which is in the west of the Central Sumatera Basin; precisely in the north of the West Kampar Block. Passey's ΔlogR technique was applied in the study area to estimate the TOC in the absence of core data. This method requires an accurate determination of the non-source rock zone along with the level of maturity (LOM). To do this, a geothermal data such as equilibrium temperature log (ETL), bottom hole temperature (BHT), and ground surface mean temperature (Ts) were gathered and corrected for creating geothermal gradient maps and evaluating the maturity level of Pematang Formation. Additionally, calculating petrophysics parameters such as shale volume (Vsh) porosity (Φ) and water saturation (Sw) is significant to estimate the non-source rock zone. Pematang Formation in the study area shows low geothermal gradient values that reach up to 18 0C/km at the Paleogene Graben. On the other hand, the northeast area represents a high geothermal gradient value (123 0C/km), and this is most likely due to the thinning of layers. Additionally, the level of maturity varies from 6.5 to 9.6, with formation temperature ranging from 57 to 127 0C. Due to the lack of uranium log data and the drawbacks of using the reduction reduced major axis (RMA) regression line, the Passey's ΔlogR method is the primary applicable method to the study area. The hydrocarbon potential of Pematang Formation is considered to be good to excellent with a range of TOC 1.12 to 17 W%, and there is a significant increase in TOC values from north to southeast. By and large, the Acoustic Impedance (AI) values prove the ability of Passey's ΔlogR method in estimating the potential Pematang Formation quality in the absence of core data.